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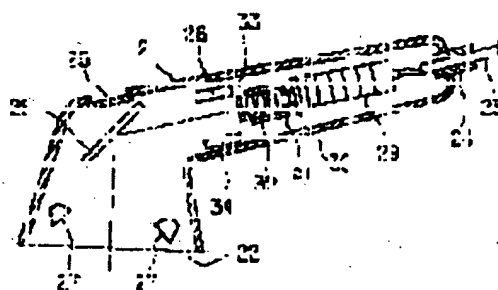
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(54) TWO-DIMENSIONAL SCANNER

(57)Abstract:

PURPOSE: To read a two-dimensional code easily and in a short period of time by making the scanner inexpensive small-sized and light in weight.

CONSTITUTION: An LED light emitting section 27 irradiating light on the secondary code of a printing medium and an angle conversion mirror 28 reflecting the reflected light from the secondary code in the direction of a handle are provided on a reading section 22 of a frame 21 which is integrally formed. A two-dimensional CCD 30 arranging the CCD element in a matrix shape, combination lens 32 forming in image the reflected light from the mirror 28 at the position of the two-dimensional CCD 30, circuit section 29 analyzing picture data obtained from an electric signal from the two-dimensional CCD 30 and outputting the two-dimensional code data to a connection cable 23, and an LCD 25 displaying the picture information read by the picture data from the circuit section 29 in real time are provided on the handle section of the frame 21.



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CLAIMS

[Claim(s)]

[Claim 1] It grasps with the read station prepared in the portable frame cast in one, and consists of the section. Said read station Close to this read station, or the light-emitting part which irradiates light at the two dimensional code printed by the print media close to that near, A reflected light include-angle conversion means to refract or reflect in said grip section the reflected light from said two dimensional code by which the light from this light-emitting part was irradiated is established. Said grip section The two-dimensional reading means which consists of structure which arranged the solid state image sensor which receives the reflected light from said two dimensional code, and outputs the electrical signal according to the quantity of light of said reflected light two-dimensional, Close to said read station, or the optical-system device section which consisted of lenses to which image formation of the reflected light by which incidence is carried out to said two-dimensional reading means through said reflected light include-angle conversion means from the two dimensional code on the print media close to the near is carried out in the location of the solid state image sensor of said two-dimensional reading means, By the image information from an image information conversion means to input the electrical signal outputted from said two-dimensional reading means, and to change into image information, and the reflected light or said image information conversion means from said print media A range display means for reading to display the range for reading read with said two-dimensional reading means on real time, The two dimensional code scanner characterized by establishing a code information analysis means to analyze the code information on said two dimensional code from the image information from said image information conversion means, and a code information output means to output the code information acquired in the analysis of this code information analysis means to an external device.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the portable two dimensional code scanner which reads the information on two dimensional codes, such as a multistage type bar code printed by print media and a matrix type code.

[0002]

[Description of the Prior Art] Generally, when registering goods information in a POS (point of sales) system etc., the label with which the bar code which coded goods information as shown in drawing 9 (a) was printed is stuck on goods, in the time of sale etc., the bar code on the label is read with a bar code scanner, and registration of goods information is performed.

[0003] As a bar code scanner, the touch type bar code scanner 1 shown, for example in drawing 10 (a), the gun type bar code scanner 2 shown in drawing 10 (b), and the fixed bar code scanner shown in drawing 10 (c) 3 grade are known.

[0004] The touch type bar code scanner 1 has and uses equipment for a hand, and it is formed at the tip of equipment. Read station 1a which consists of an LED (light emitting diode) light-emitting part and two or more CCD (charge coupled device) components arranged by one train is stuck to the bar code printed on the label. By carrying out ON actuation of the code reading switch 1b, LED of an LED light-emitting part is made to emit light, the reflected light from the bar code of the light is received by each CCD component, and a bar code is read. And if the read of a bar code carries out reading completion normally, reading completion lamp 1c which consists of LED prepared in the equipment top face will light up.

[0005] Moreover, it is used having equipment in a hand and read station 2a which consists of a laser light-emitting part and a CCD component is formed in the front upper part of equipment, and by carrying out ON actuation of the code reading switch 2b, a laser beam scans the bar code printed on the label from read station 2a, and the gun type bar code scanner 2 receives the reflected light by the CCD component, and reads a bar code.

[0006] Furthermore, equipment is used for a position, carrying out fixed installation, read station 3a which consists of a laser light-emitting part and a CCD component is formed in the front face of equipment, and goods are the timing which passes through the front face of equipment, and the fixed bar code scanner 3 scans the bar code by which the laser beam was printed on the label from read station 3a, receives the reflected light by the CCD component, and reads a bar code.

[0007] With an interconnection cable, it connects with the host computer which processes goods information, and each bar code scanner mentioned above outputs the bar code information read, respectively to a host computer through the interconnection cable, respectively. With a host computer, registration of goods information is performed based on the inputted bar code information.

[0008] Thus, it has spread with FA (factory automation), circulation, a service industry, etc., the class of information to treat is also various, and the field which uses the bar code which coded predetermined information and performs registration processing, etc. information management, etc. of goods information is in the inclination which needs big amount of information.

[0009] Therefore, with increase of amount of information, by one step of bar code, since information density is low, the amount of information which can be coded becomes insufficient. Then, since information density was raised and it corresponded to increase of the amount of information, the two dimensional code shown in the multistage bar code and multistage drawing 9 (c) shown in drawing 9 (b) was developed.

[0010] As what reads such a multistage bar code and a two dimensional code, TV (television) camera method two dimensional code scanner as shown in the former, for example, drawing 11, is known. This TV camera method two

dimensional code scanner consists of TV monitors 13 connected with ***** 12 connected with the host computer for processing information through the circuit (RS-232C circuit) and this image processing system 12, and an interconnection cable while connecting with TV camera 11, and this TV camera 11 and interconnection cable.

[0011] With such a TV camera method two dimensional code scanner, the field where the two dimensional code of the label 14 stuck on goods was printed is countered, TV camera 11 is set, the two dimensional code on a label 14 is photoed with TV camera 11 under the usual indoor lighting, the image data photoed and obtained is processed with an image processing system 12, and it changes into two dimensional code information. This two dimensional code information is transmitted to a host computer through a circuit. On the other hand, the photoed image data is outputted to the TV monitor 13 through an interconnection cable as it is, and the photoed image is displayed on the TV monitor 13.

[0012]

[Problem(s) to be Solved by the Invention] Although the TV camera method two dimensional code scanner mentioned above was known as equipment which reads a two dimensional code conventionally as mentioned above, TV camera 11, an image processing system 12, and the equipment of the TV monitor 13 were required, weight and a configuration were large as the whole equipment, and there was a problem of being expensive.

[0013] Moreover, while countering TV camera 11 and setting the label 14 perpendicularly to the optical path, according to the distance of TV camera 11 and a label 14, the focus of TV camera 11 needed to be adjusted and there was a problem that adjusting a diaphragm of TV camera 11 according to the brightness of indoor lighting etc. required time amount for housekeeping performed before the read of a two dimensional code.

[0014] Then, this invention can be cheaply constituted from a small light weight, and aims at offering the two dimensional code scanner which can moreover read a two dimensional code easily in a short time.

[0015]

[Means for Solving the Problem] This invention grasps with the read station prepared in the portable frame cast in one, and consists of the section. A read station Close to this read station, or the light-emitting part which irradiates light at the two dimensional code printed by the print media close to that near, The reflected light include-angle conversion means which grasps the reflected light from the two dimensional code by which the light from this light-emitting part was irradiated, and is refracted or reflected in the section is established. The grip section The two-dimensional reading means which consists of structure which arranged the solid state image sensor which receives the reflected light from a two dimensional code, and outputs the electrical signal according to the quantity of light of the reflected light two-dimensional, Close to a read station, or the optical-system device section which consisted of lenses to which image formation of the reflected light by which incidence is carried out to a two-dimensional reading means through a reflected light include-angle conversion means from the two dimensional code on the print media close to the near is carried out in the location of the solid state image sensor of a two-dimensional reading means, By the image information from an image information conversion means to input the electrical signal outputted from the two-dimensional reading means, and to change into image information, and the reflected light or the image information conversion means from print media A range display means for reading to display the range for reading read with a two-dimensional reading means on real time, A code information analysis means to analyze the code information on a two dimensional code from the image information from an image information conversion means, and a code information output means to output the code information acquired in the analysis of this code information analysis means to an external device are established.

[0016]

[Function] In this invention of such a configuration, if the read station of this equipment is made to approach even close to the two dimensional code printed by print media, or its near, the light from a light-emitting part will be irradiated by the two dimensional code. It grasps with a reflected light include-angle conversion means, and is refracted or reflected in the section, and image formation of the reflected light from this two dimensional code is carried out in the location of two or more solid state image sensors which constitute a two-dimensional reading means by the optical-system device section.

[0017] Each solid state image sensor of a two-dimensional reading means outputs the electrical signal according to the quantity of light of the reflected light in which image formation was carried out by the optical-system device section, and an image information conversion means changes those electrical signals into image information.

[0018] From the signal currently outputted from each solid state image sensor of the reflected light from print media, or a two-dimensional reading means, the range for reading read with a two-dimensional reading means is displayed on real time by the range display means for reading. Therefore, supervising this displayed range for reading, the operator of this equipment can move this equipment for a short time so that a two dimensional code may be correctly positioned

by the reading station of normal.

[0019] Therefore, a two dimensional code is positioned by the accuracy of the reading station of normal, and is read by the two-dimensional reading means. Here, a code information analysis means analyzes code information from the image information changed by the image information conversion means, and this analyzed code information is outputted to an external device by the code information output means.

[0020]

[Example] Hereafter, one example of this invention is explained with reference to a drawing. In addition, this example is what applied this invention to the two-dimensional handy scanner, drawing 1 is the perspective view of this two-dimensional handy scanner, and drawing 2 is the sectional view of this two-dimensional handy scanner.

[0021] 21 is the frame formed by uniting with hollow structure with plastics etc., the end serves as opening with a small opening area, and the other end serves as opening with a large opening area as a read station 22. The interconnection cable 23 which consists of a power-source line and a signal line is inserted in opening with the small end of said frame 21, and it is being fixed to said frame 21 by the protection member 24. Opening is formed also in the upper part of said frame 21, LCD (liquid crystal display) 25 is formed in this opening, and the code reading switch 26 with which actuation of read initiation of a two dimensional code is performed is formed in the side face of said frame 21.

[0022] When the part of the side in which opening with the small end of said frame 21 was formed approaches or sticks said read station 22 to the print media by which the two dimensional code was printed as the grip section, to the vertical line of the printing side of a two dimensional code, the medial axis of the grip section is larger than at least 90 degrees, and it is formed so that it may become about 110 degrees.

[0023] Two or more arrangement of the LED light-emitting part 27 as a light-emitting part which turns into said read station 22 interior which is opening with the large other end of said frame 21 from the diffusion lens made from plastics which makes homogeneity diffuse the light from LED and this LED, respectively is carried out at a circle configuration or the shape of a circularly near regular polygon. Moreover, the include-angle conversion mirror 28 as a reflected light include-angle conversion means is installed in the back by the pan of said read station 22 interior at an angle of predetermined to the direction of said read station 22. In addition, although the include-angle conversion mirror 28 was used here, prism etc. may be used instead.

[0024] Moreover, the circuit [in which opening with the small end of said frame 21 was formed] section 29 electrically connected to said interconnection cable 23 inside the section side by grasping, and two-dimensional CCD (charge coupled device) 30 as a two-dimensional reading means are installed.

[0025] Said circuit section 29 consists of the main control section which consisted of CPU (central processing unit) and the various memory which constitute LCD and the buzzer control section which controls a power-source interface circuitry, said LCD 25, the buzzer mentioned later, and a control-section body, the decoding section, a code image-processing circuit, an image pick-up digital disposal circuit, etc. Each circuit of this circuit section 29 has multilayer substrate structure, mounts the chip which constitutes each circuit in one side or both sides of each substrate, and is formed.

[0026] Corresponding to said include-angle conversion mirror 28, a CCD component is arranged in the shape of a matrix (the number of effective pixels in order [The number of effective pixels] to correspond to 250,000 pixels and a still higher-density two dimensional code 400,000 pixels or more), and the cage to which said circuit section 29 and said two-dimensional CCD 30 are connected electrically, and this two-dimensional CCD 30 are constituted. In addition, although the CCD component was used, the solid state image sensor of other methods may be used for a change here.

[0027] Between said two-dimensional CCD 30 and said include-angle conversion mirror 28, the filter 33 which decreases the diaphragm device 31, the combination lens 32, and an unnecessary outpatient department light which adjust the amount of transparency of light is arranged in order. When print media, such as a label with which the two dimensional code was printed by said read station 22, approaches less than 10mm, the focus of said combination lens 32 is adjusted so that it may become the contrast in which binary-izing of a two dimensional code is possible.

[0028] In addition, although the combination lens 32 is used here, this is for making small distortion produced in the image which received light as much as possible, and may use the aspheric lens which can make distortion small as much as possible instead. Moreover, in said combination lens 32, when generating of the ghost by reflection of a lens side poses a problem, what processed antireflection coating etc. may be used for a lens front face.

[0029] The optical-system device section is constituted by said drawing device 31, said combination lens 32, and said filter 33.

[0030] Moreover, said circuit section 29 is electrically connected also with the buzzer 34 formed in the interior of said frame 21 while connecting with said code reading switch 26 electrically.

[0031] The block diagram showing the important section circuitry of said circuit section 29 of this two-dimensional

handy scanner in drawing 3 is shown. Said main control section EEPROM (electrically erasable programmable read only memory) 42 the program data and initial setting of the processing which said CPU41 to constitute performs were remembered to be, and said CPU41 processing It corresponds to the various kinds of DRAM (dynamic random access memory) 43 in which the area of the various memory used when carrying out was formed, and an attached two-dimensional symbol (two dimensional code). It is based on the mask ROM (read only memory) 44 the read format was remembered to be, and a read format from this mask ROM 44. Serial I/F (interface) 46 connected with external information processors which change the read image data into code data, such as the decoding circuit (decoding GA (gate array)) 45 and a host computer, through a serial circuit It connects with said CPU41 through the system bus 47, respectively.

[0032] moreover While controlling said code image-processing circuit 48 and said two-dimensional CCD30 The signal from this two-dimensional CCD30 While usually reading based on the image data from said code image-processing circuit 48 to said image pick-up digital disposal circuit 49 to amplify, the light source driver 50 which carries out the lighting drive of the LED27a which constitutes said LED light-emitting part 27, and said LCD25 and displaying the image range The I/O (input/output) port 52 which outputs a driving signal to said buzzer 34 while inputting the display drive circuit 51 on which an error or read completion is displayed by control of said CPU41, and the output signal from said code reading switch 26 It connects with said CPU41 through said system bus 47, respectively. The range display means for reading is constituted by said LCD25 and said display drive circuit 51.

[0033] Therefore, said LCD and buzzer control section consist of said display drive circuits 51 and I/O Ports 52, said main control section consists of said CPU41, EEPROM42 and DRAM43, and serial I/F 46, and said decoding section is constituted from said mask ROM 44 and the decoding circuit 45 by said circuit section 29.

[0034] Moreover, an image information conversion means is constituted by said image pick-up digital disposal circuit 49 and said code image-processing circuit 48, a code information analysis means is constituted by said mask ROM 44 and the decoding circuit 45, and the code information output means is constituted by serial I/F 46.

[0035] A/D (analogue/digital) conversion circuit 48a to which said code image-processing circuit 48 carries out digital conversion of the image pick-up signal (each pixel signal) from said image pick-up digital disposal circuit 49 as shown in drawing 4 (a), The digital data from this A/D-conversion circuit 48a is made binary with the SURESSHORUDO value set up beforehand. As opposed to the image data mapped on frame memory 48b by which image data is mapped with that binary-ized data, and this frame memory 48b After processing concentration amendment, emphasis processing, smoothing, etc., while starting the image data of only a two dimensional code, it consists of image-processing circuit 48c which processes rotation, a feature extraction, etc. and changes the started image data into the two dimensional code image data of normal. And said A/D-conversion circuit 48a, said frame memory 48b, and said image-processing circuit 48c are connected to said system bus 47, respectively.

[0036] Moreover, digital-disposal-circuit 49a which inputs and amplifies the output signal from said two-dimensional CCD30 while connecting with said system bus 47, as said image pick-up digital disposal circuit 49 is shown in drawing 4 (b), ROM(read only memory) 49b the information on dispersion in each CCD component generated on manufacture in said two-dimensional CCD30 (defect) was remembered to be, Defective amendment circuit 49c which amends the reading timing in each CCD component based on the information memorized by this ROM49b, 49d of shutter control circuits which set up a read time when the print media by which the two dimensional code was printed is a mobile, Timing generating circuit 49e which generates reading timing based on the signal from said defective amendment circuit 49c and 49d of said shutter control circuits, Based on the reading timing generated in this timing generating circuit 49e, it sets to said two-dimensional CCD30. It consists of 49h of synchronizing signal circuits which control the timing which outputs a picture signal to said digital-disposal-circuit 49a from perpendicular driver 49f which specifies the CCD component to read, respectively and level driver 49g, and said two-dimensional CCD30.

[0037] The flow chart of the reading processing which said CPU41 performs to drawing 5 is shown.

[0038] First, if it will be in a standby condition until ON actuation of the code reading switch 26 is carried out and ON actuation of the code reading switch 26 is carried out, it will energize to LED27a of the LED light-emitting part 27, and it will be switched on.

[0039] Next, as processing of step 1 (ST1), two-dimensional CCD30 is controlled by the image pick-up digital disposal circuit 49, and reading actuation is started. The code image-processing circuit 48 performs binary-ization, the image pick-up signal which read by this two-dimensional CCD30, and was amplified is transmitted to frame memory 48b, and image data is mapped. The image data of only a two dimensional code is started from this mapped image data, various code image processings are performed to the image data of only this started two dimensional code, it changes into the two dimensional code image data of normal, and DRAM43 is made to memorize.

[0040] The two dimensional code image data of the normal which this DRAM43 was made to memorize is transmitted

to the decoding circuit 45, and decoding which changes this two dimensional code image data into two dimensional code data is performed.

[0041] It judges whether decoding was completed normally here (O.K.). If decoding cannot be completed normally (i.e., if not convertible for two dimensional code data), the display which shows a read error is performed by LCD25, and it returns to processing of the above-mentioned step 1 again.

[0042] Moreover, if decoding is completed normally, will stop the energization to LED27a, the light will be made to put out, and the display which shows reading completion will be performed by LCD25, or a buzzer 34 will be sounded and reported. Next, the two dimensional code data obtained by decoding are transmitted to information processors, such as a host computer, through an interconnection cable 23 by serial I/F 46.

[0043] If transmitting termination of the two dimensional code data is carried out through an interconnection cable 23 by serial I/F 46, it will return to processing of the beginning of this reading processing again.

[0044] In this example of such a configuration, the KARURA code ***** [which was printed by the label stuck on goods, for example] case shown in drawing 9 (c) is explained.

[0045] First, if the read station 22 of this two dimensional code scanner is made to approach the KARURA code of a label and ON actuation of the code reading switch 26 is carried out, the LED light-emitting part 27 will light up. The light from this LED light-emitting part 27 is irradiated by the KARURA code on a label, and the reflected light from this KARURA code is reflected in the direction of two-dimensional CCD30 by the include-angle conversion mirror 28. Outpatient department light decreases with a filter 33, and image formation of this reflected light is carried out through the diaphragm device 31 with the combination lens 32 in the location of two-dimensional CCD30.

[0046] Here, the reflected light which carried out image formation is changed into the electrical signal of the voltage level according to light income by each CCD component of two-dimensional CCD30, respectively. This electrical signal is amplified by the image pick-up digital disposal circuit 49 to predetermined timing, and is transmitted to the code image-processing circuit 48 as an image pick-up signal.

[0047] An image pick-up signal is changed into image data in the code image-processing circuit 48. At this time, the display drive circuit 51 displays the image information read to LCD25 based on this image data. On the other hand, to the changed image data, the code image-processing circuit 48 starts image data by the KARURA code section further, performs various code processings to this started image data only for a KARURA code section, and changes them into the two dimensional code image data of normal.

[0048] Based on a format of the KARURA code which was memorized by DRAM43 and memorized by the mask ROM 44, decoding of the two dimensional code image data of this normal is carried out by the decoding circuit 45, and it is outputted to a host computer etc. through an interconnection cable 23 as KARURA code data.

[0049] For example, since it is displayed in the center of LCD25 as shown in drawing 6 (a) when a two dimensional code scanner is made to approach the KARURA code of a label, and the KARURA code is positioned by the reading station of normal, if an operator can check that the KARURA code is positioned by the reading station of normal and ON actuation of the code reading switch 26 is carried out immediately, he can read a KARURA code correctly.

[0050] moreover, when the KARURA code has separated from the reading station of normal Since it is separated and displayed from the display screen of LCD25 as shown in drawing 6 (b) If an operator makes it move so that it may become the image which shows this two dimensional code scanner to drawing 6 (a) while a KARURA code can notice it separating and being from the reading station of normal and supervises this LCD25 A KARURA code can be positioned easily [the reading station of normal] in a short time. And if ON actuation of the code reading switch 26 is carried out when a KARURA code is displayed in the center of LCD25, a KARURA code can be read correctly.

[0051] Moreover, although the KARURA code is positioned by the reading station of normal Since the KARURA code which leans in the center is displayed on LCD25 as shown in drawing 6 (c) also when inclined and positioned (rotating) If an operator makes it move so that it may become the image which shows this two dimensional code scanner to drawing 6 (a) while a KARURA code can notice being inclined and positioned and supervises this LCD25 A KARURA code can be positioned easily [there is no inclination in the reading station of normal (without it is rotating), and]. And if ON actuation of the code reading switch 26 is carried out when a KARURA code is displayed that there is no inclination in the center of LCD25, a KARURA code can be read correctly.

[0052] According to this example, to thus, the read station 22 of the frame 21 cast by one apparatus The include-angle conversion mirror 28 which grasps the LED light-emitting part 27 which irradiates light at the print media by which the two dimensional code was printed, and the reflected light from a two dimensional code, and is reflected in the direction of the section is formed. Two-dimensional CCD30 constituted by arranging a CCD component in the shape of a matrix by the grip section of a frame 21, A filter 33 and the combination lens 32 to which image formation of the reflected light from the include-angle conversion mirror 28 is carried out in the location of two-dimensional CCD30, The

drawing device 31 and the circuit section 29 which creates image data with the electrical signal outputted from two-dimensional CCD30, analyzes this image data, and outputs two dimensional code data to an interconnection cable 23, By having formed LCD25 which displays the image information read by the image information from the code image-processing circuit 48 on real time, it can constitute from a light weight small as equipment which reads a two dimensional code cheaply. Furthermore, since read actuation is automatically performed only by change of the lighting which irradiates light not adjusting a diaphragm to focal adjustment or focal print media, and carrying out ON actuation of the code read switch 26, since the read station 22 of this equipment is made to approach the print media by which the two dimensional code was printed and read is performed to it, a two dimensional code can be read easily in a short time.

[0053] Moreover, since the image read by this two-dimensional CCD30 can be checked by LCD25 on real time when a two dimensional code scanner is made to approach the print media by which the two dimensional code was printed, since the image information read on real time is displayed on LCD25, a two dimensional code can be positioned easily [there is no inclination in the reading station of normal, and]. Therefore, a two dimensional code can be read correctly.

[0054] Other examples of this invention are explained with reference to drawing 7 and drawing 8 . Although the example mentioned above displayed the image to read based on the image information which formed the display drive circuit 51 and LCD25, and was obtained from two-dimensional CCD30 In this example, as shown in drawing 7 , the include-angle conversion mirror 28 in the above-mentioned example is transposed to the include-angle conversion half mirror 61. The light penetrated with this include-angle conversion half mirror 61 carries out opening formation at the part irradiated by the frame 21, and forms the window part 62 fitted in and formed in this opening in clear glass or a transparent plastic. Therefore, as shown in drawing 8 , it is not necessary to form the display drive circuit 51 and LCD25. In addition, about other configuration members and circuitry, since it is an above-mentioned example and identitas, the explanation is omitted here.

[0055] When a two dimensional code scanner is made to approach the two dimensional code printed by print media in this example of such a configuration If the two dimensional code is not positioned by the reading station of normal, since the two dimensional code is not displayed in the center of a window part 62 An operator can position a two dimensional code easily [the reading station of normal] in a short time, being able to notice that the two dimensional code is not positioned by the reading station of normal, and supervising a window part 62. And if ON actuation of the code reading switch 26 is carried out when a two dimensional code is displayed in the center of a window part 62, a two dimensional code can be read correctly.

[0056] Moreover, although the two dimensional code is positioned by the reading station of normal, since a two dimensional code leaning to the window part 62 is displayed also when inclined and positioned (rotating), an operator can position a two dimensional code easily [there is no inclination in the reading station of normal, and], if this two dimensional code scanner is moved while a two dimensional code can notice being inclined and positioned and supervises a window part 62.

[0057] And if ON actuation of the code reading switch 26 is carried out when a two dimensional code is displayed that there is no inclination in the center of a window part 62, a two dimensional code can be read correctly.

[0058] Thus, also in this example, the same effectiveness as the example mentioned above can be acquired. Furthermore, since it is not related to a circuit etc. at all in this example, the effectiveness of affecting a circuit etc. moreover cheaply or not being influenced with a simple configuration can also be acquired.

[0059]

[Effect of the Invention] As explained in full detail above, according to this invention, it can constitute from a small light weight cheaply, and the two dimensional code scanner which can moreover read a two dimensional code easily in a short time can be offered.

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TECHNICAL FIELD

[Industrial Application] This invention relates to the portable two dimensional code scanner which reads the information on two dimensional codes, such as a multistage type bar code printed by print media and a matrix type code.

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PRIOR ART

[Description of the Prior Art] Generally, when registering goods information in a POS (point of sales) system etc., the label with which the bar code which coded goods information as shown in drawing 9 (a) was printed is stuck on goods, in the time of sale etc., the bar code on the label is read with a bar code scanner, and registration of goods information is performed.

[0003] As a bar code scanner, the touch type bar code scanner 1 shown, for example in drawing 10 (a), the gun type bar code scanner 2 shown in drawing 10 (b), and the fixed bar code scanner shown in drawing 10 (c) 3 grade are known.

[0004] The touch type bar code scanner 1 has and uses equipment for a hand, and it is formed at the tip of equipment. Read station 1a which consists of an LED (light emitting diode) light-emitting part and two or more CCD (charge coupled device) components arranged by one train is stuck to the bar code printed on the label. By carrying out ON actuation of the code reading switch 1b, LED of an LED light-emitting part is made to emit light, the reflected light from the bar code of the light is received by each CCD component, and a bar code is read. And if the read of a bar code carries out reading completion normally, reading completion lamp 1c which consists of LED prepared in the equipment top face will light up.

[0005] Moreover, it is used having equipment in a hand and read station 2a which consists of a laser light-emitting part and a CCD component is formed in the front upper part of equipment, and by carrying out ON actuation of the code reading switch 2b, a laser beam scans the bar code printed on the label from read station 2a, and the gun type bar code scanner 2 receives the reflected light by the CCD component, and reads a bar code.

[0006] Furthermore, equipment is used for a position, carrying out fixed installation, read station 3a which consists of a laser light-emitting part and a CCD component is formed in the front face of equipment, and goods are the timing which passes through the front face of equipment, and the fixed bar code scanner 3 scans the bar code by which the laser beam was printed on the label from read station 3a, receives the reflected light by the CCD component, and reads a bar code.

[0007] With an interconnection cable, it connects with the host computer which processes goods information, and each bar code scanner mentioned above outputs the bar code information read, respectively to a host computer through the interconnection cable, respectively. With a host computer, registration of goods information is performed based on the inputted bar code information.

[0008] Thus, it has spread with FA (factory automation), circulation, a service industry, etc., the class of information to treat is also various, and the field which uses the bar code which coded predetermined information and performs registration processing, etc. information management, etc. of goods information is in the inclination which needs big amount of information.

[0009] Therefore, with increase of amount of information, by one step of bar code, since information density is low, the amount of information which can be coded becomes insufficient. Then, since information density was raised and it corresponded to increase of the amount of information, the two dimensional code shown in the multistage bar code and multistage drawing 9 (c) shown in drawing 9 (b) was developed.

[0010] As what reads such a multistage bar code and a two dimensional code, TV (television) camera method two dimensional code scanner as shown in the former, for example, drawing 11, is known. This TV camera method two dimensional code scanner consists of TV monitors 13 connected with ***** 12 connected with the host computer for processing information through the circuit (RS-232C circuit) and this image processing system 12, and an interconnection cable while connecting with TV camera 11, and this TV camera 11 and interconnection cable.

[0011] With such a TV camera method two dimensional code scanner, the field where the two dimensional code of the label 14 stuck on goods was printed is countered, TV camera 11 is set, the two dimensional code on a label 14 is photoed with TV camera 11 under the usual indoor lighting, the image data photoed and obtained is processed with an

image processing system 12, and it changes into two dimensional code information. This two dimensional code information is transmitted to a host computer through a circuit. On the other hand, the photoed image data is outputted to the TV monitor 13 through an interconnection cable as it is, and the photoed image is displayed on the TV monitor 13.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, according to this invention, it can constitute from a small light weight cheaply, and the two dimensional code scanner which can moreover read a two dimensional code easily in a short time can be offered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Although the TV camera method two dimensional code scanner mentioned above was known as equipment which reads a two dimensional code conventionally as mentioned above, TV camera 11, an image processing system 12, and the equipment of the TV monitor 13 were required, weight and a configuration were large as the whole equipment, and there was a problem of being expensive.

[0013] Moreover, while countering TV camera 11 and setting the label 14 perpendicularly to the optical path, according to the distance of TV camera 11 and a label 14, the focus of TV camera 11 needed to be adjusted and there was a problem that adjusting a diaphragm of TV camera 11 according to the brightness of indoor lighting etc. required time amount for housekeeping performed before the read of a two dimensional code.

[0014] Then, this invention can be cheaply constituted from a small light weight, and aims at offering the two dimensional code scanner which can moreover read a two dimensional code easily in a short time.

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MEANS

[Means for Solving the Problem] This invention grasps with the read station prepared in the portable frame cast in one, and consists of the section. A read station Close to this read station, or the light-emitting part which irradiates light at the two dimensional code printed by the print media close to that near, The reflected light include-angle conversion means which grasps the reflected light from the two dimensional code by which the light from this light-emitting part was irradiated, and is refracted or reflected in the section is established. The grip section The two-dimensional reading means which consists of structure which arranged the solid state image sensor which receives the reflected light from a two dimensional code, and outputs the electrical signal according to the quantity of light of the reflected light two-dimensional, Close to a read station, or the optical-system device section which consisted of lenses to which image formation of the reflected light by which incidence is carried out to a two-dimensional reading means through a reflected light include-angle conversion means from the two dimensional code on the print media close to the near is carried out in the location of the solid state image sensor of a two-dimensional reading means, By the image information from an image information conversion means to input the electrical signal outputted from the two-dimensional reading means, and to change into image information, and the reflected light or the image information conversion means from print media A range display means for reading to display the range for reading read with a two-dimensional reading means on real time, A code information analysis means to analyze the code information on a two dimensional code from the image information from an image information conversion means, and a code information output means to output the code information acquired in the analysis of this code information analysis means to an external device are established.

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OPERATION

[Function] In this invention of such a configuration, if the read station of this equipment is made to approach even close to the two dimensional code printed by print media, or its near, the light from a light-emitting part will be irradiated by the two dimensional code. It grasps with a reflected light include-angle conversion means, and is refracted or reflected in the section, and image formation of the reflected light from this two dimensional code is carried out in the location of two or more solid state image sensors which constitute a two-dimensional reading means by the optical-system device section.

[0017] Each solid state image sensor of a two-dimensional reading means outputs the electrical signal according to the quantity of light of the reflected light in which image formation was carried out by the optical-system device section, and an image information conversion means changes those electrical signals into image information.

[0018] From the signal currently outputted from each solid state image sensor of the reflected light from print media, or a two-dimensional reading means, the range for reading read with a two-dimensional reading means is displayed on real time by the range display means for reading. Therefore, supervising this displayed range for reading, the operator of this equipment can move this equipment for a short time so that a two dimensional code may be correctly positioned by the reading station of normal.

[0019] Therefore, a two dimensional code is positioned by the accuracy of the reading station of normal, and is read by the two-dimensional reading means. Here, a code information analysis means analyzes code information from the image information changed by the image information conversion means, and this analyzed code information is outputted to an external device by the code information output means.

[Translation done.]

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EXAMPLE

[Example] Hereafter, one example of this invention is explained with reference to a drawing. In addition, this example is what applied this invention to the two-dimensional handy scanner, drawing 1 is the perspective view of this two-dimensional handy scanner, and drawing 2 is the sectional view of this two-dimensional handy scanner.

[0021] 21 is the frame formed by uniting with hollow structure with plastics etc., the end serves as opening with a small opening area, and the other end serves as opening with a large opening area as a read station 22. The interconnection cable 23 which consists of a power-source line and a signal line is inserted in opening with the small end of said frame 21, and it is being fixed to said frame 21 by the protection member 24. Opening is formed also in the upper part of said frame 21, LCD (liquid crystal display) 25 is formed in this opening, and the code reading switch 26 with which actuation of read initiation of a two dimensional code is performed is formed in the side face of said frame 21.

[0022] When the part of the side in which opening with the small end of said frame 21 was formed approaches or sticks said read station 22 to the print media by which the two dimensional code was printed as the grip section, to the vertical line of the printing side of a two dimensional code, the medial axis of the grip section is larger than at least 90 degrees, and it is formed so that it may become about 110 degrees.

[0023] Two or more arrangement of the LED light-emitting part 27 as a light-emitting part which turns into said read station 22 interior which is opening with the large other end of said frame 21 from the diffusion lens made from plastics which makes homogeneity diffuse the light from LED and this LED, respectively is carried out at a circle configuration or the shape of a circularly near regular polygon. Moreover, the include-angle conversion mirror 28 as a reflected light include-angle conversion means is installed in the back by the pan of said read station 22 interior at an angle of predetermined to the direction of said read station 22. In addition, although the include-angle conversion mirror 28 was used here, prism etc. may be used instead.

[0024] Moreover, the circuit [in which opening with the small end of said frame 21 was formed] section 29 electrically connected to said interconnection cable 23 inside the section side by grasping, and two-dimensional CCD (charge coupled device) 30 as a two-dimensional reading means are installed.

[0025] Said circuit section 29 consists of the main control section which consisted of CPU (cen-tral processing unit) and the various memory which constitute LCD and the buzzer control section which controls a power-source interface circuitry, said LCD 25, the buzzer mentioned later, and a control-section body, the decoding section, a code image-processing circuit, an image pick-up digital disposal circuit, etc. Each circuit of this circuit section 29 has multilayer substrate structure, mounts the chip which constitutes each circuit in one side or both sides of each substrate, and is formed.

[0026] Corresponding to said include-angle conversion mirror 28, a CCD component is arranged in the shape of a matrix (the number of effective pixels in order [The number of effective pixels] to correspond to 250,000 pixels and a still higher-density two dimensional code 400,000 pixels or more), and the cage to which said circuit section 29 and said two-dimensional CCD 30 are connected electrically, and this two-dimensional CCD 30 are constituted. In addition, although the CCD component was used, the solid state image sensor of other methods may be used for a change here.

[0027] Between said two-dimensional CCD 30 and said include-angle conversion mirror 28, the filter 33 which decreases the diaphragm device 31, the combination lens 32, and an unnecessary outpatient department light which adjust the amount of transparency of light is arranged in order. When print media, such as a label with which the two dimensional code was printed by said read station 22, approaches less than 10mm, the focus of said combination lens 32 is adjusted so that it may become the contrast in which binary-izing of a two dimensional code is possible.

[0028] In addition, although the combination lens 32 is used here, this is for making small distortion produced in the image which received light as much as possible, and may use the aspheric lens which can make distortion small as much as possible instead. Moreover, in said combination lens 32, when generating of the ghost by reflection of a lens

side poses a problem, what processed antireflection coating etc. may be used for a lens front face.

[0029] The optical-system device section is constituted by said drawing device 31, said combination lens 32, and said filter 33.

[0030] Moreover, said circuit section 29 is electrically connected also with the buzzer 34 formed in the interior of said frame 21 while connecting with said code reading switch 26 electrically.

[0031] The block diagram showing the important section circuitry of said circuit section 29 of this two-dimensional handy scanner in drawing 3 is shown. Said main control section EEPROM (electrically erasable programmable read only memory) 42 the program data and initial setting of the processing which said CPU41 to constitute performs were remembered to be, and said CPU41 processing It corresponds to the various kinds of DRAM (dynamic random access mem-ory) 43 in which the area of the various memory used when carrying out was formed, and an attached two-dimensional symbol (two dimensional code). It is based on the mask ROM (read only memory) 44 the read format was remembered to be, and a read format from this mask ROM 44. Serial I/F (interface) 46 connected with external information processors which change the read image data into code data, such as the decoding circuit (decoding GA (gate array)) 45 and a host computer, through a serial circuit It connects with said CPU41 through the system bus 47, respectively.

[0032] moreover While controlling said code image-processing circuit 48 and said two-dimensional CCD30 The signal from this two-dimensional CCD30 While usually reading based on the image data from said code image-processing circuit 48 to said image pick-up digital disposal circuit 49 to amplify, the light source driver 50 which carries out the lighting drive of the LED27a which constitutes said LED light-emitting part 27, and said LCD25 and displaying the image range The I/O (input/output) port 52 which outputs a driving signal to said buzzer 34 while inputting the display drive circuit 51 on which an error or read completion is displayed by control of said CPU41, and the output signal from said code reading switch 26 It connects with said CPU41 through said system bus 47, respectively. The range display means for reading is constituted by said LCD25 and said display drive circuit 51.

[0033] Therefore, said LCD and buzzer control section consist of said display drive circuits 51 and I/O Ports 52, said main control section consists of said CPU41, EEPROM42 and DRAM43, and serial I/F 46, and said decoding section is constituted from said mask ROM 44 and the decoding circuit 45 by said circuit section 29.

[0034] Moreover, an image information conversion means is constituted by said image pick-up digital disposal circuit 49 and said code image-processing circuit 48, a code information analysis means is constituted by said mask ROM 44 and the decoding circuit 45, and the code information output means is constituted by serial I/F 46.

[0035] A/D (analogue/digital) conversion circuit 48a to which said code image-processing circuit 48 carries out digital conversion of the image pick-up signal (each pixel signal) from said image pick-up digital disposal circuit 49 as shown in drawing 4 (a), The digital data from this A/D-conversion circuit 48a is made binary with the SURESSHORUDO value set up beforehand. As opposed to the image data mapped on frame memory 48b by which image data is mapped with that binary-ized data, and this frame memory 48b After processing concentration amendment, emphasis processing, smoothing, etc., while starting the image data of only a two dimensional code, it consists of image-processing circuit 48c which processes rotation, a feature extraction, etc. and changes the started image data into the two dimensional code image data of normal. And said A/D-conversion circuit 48a, said frame memory 48b, and said image-processing circuit 48c are connected to said system bus 47, respectively.

[0036] Moreover, digital-disposal-circuit 49a which inputs and amplifies the output signal from said two-dimensional CCD30 while connecting with said system bus 47, as said image pick-up digital disposal circuit 49 is shown in drawing 4 (b), ROM(read only mem-ory) 49b the information on dispersion in each CCD component generated on manufacture in said two-dimensional CCD30 (defect) was remembered to be, Defective amendment circuit 49c which amends the reading timing in each CCD component based on the information memorized by this ROM49b, 49d of shutter control circuits which set up a read time when the print media by which the two dimensional code was printed is a mobile, Timing generating circuit 49e which generates reading timing based on the signal from said defective amendment circuit 49c and 49d of said shutter control circuits, Based on the reading timing generated in this timing generating circuit 49e, it sets to said two-dimensional CCD30. It consists of 49h of synchronizing signal circuits which control the timing which outputs a picture signal to said digital-disposal-circuit 49a from perpendicular driver 49f which specifies the CCD component to read, respectively and level driver 49g, and said two-dimensional CCD30.

[0037] The flow chart of the reading processing which said CPU41 performs to drawing 5 is shown.

[0038] First, if it will be in a standby condition until ON actuation of the code reading switch 26 is carried out and ON actuation of the code reading switch 26 is carried out, it will energize to LED27a of the LED light-emitting part 27, and it will be switched on.

[0039] Next, as processing of step 1 (ST1), two-dimensional CCD30 is controlled by the image pick-up digital disposal

circuit 49, and reading actuation is started. The code image-processing circuit 48 performs binary-ization, the image pick-up signal which read by this two-dimensional CCD30, and was amplified is transmitted to frame memory 48b, and image data is mapped. The image data of only a two dimensional code is started from this mapped image data, various code image processings are performed to the image data of only this started two dimensional code, it changes into the two dimensional code image data of normal, and DRAM43 is made to memorize.

[0040] The two dimensional code image data of the normal which this DRAM43 was made to memorize is transmitted to the decoding circuit 45, and decoding which changes this two dimensional code image data into two dimensional code data is performed.

[0041] It judges whether decoding was completed normally here (O.K.). If decoding cannot be completed normally (i.e., if not convertible for two dimensional code data), the display which shows a read error is performed by LCD25, and it returns to processing of the above-mentioned step 1 again.

[0042] Moreover, if decoding is completed normally, will stop the energization to LED27a, the light will be made to put out, and the display which shows reading completion will be performed by LCD25, or a buzzer 34 will be sounded and reported. Next, the two dimensional code data obtained by decoding are transmitted to information processors, such as a host computer, through an interconnection cable 23 by serial I/F 46.

[0043] If transmitting termination of the two dimensional code data is carried out through an interconnection cable 23 by serial I/F 46, it will return to processing of the beginning of this reading processing again.

[0044] In this example of such a configuration, the KARURA code ***** [which was printed by the label stuck on goods, for example] case shown in drawing 9 (c) is explained.

[0045] First, if the read station 22 of this two dimensional code scanner is made to approach the KARURA code of a label and ON actuation of the code reading switch 26 is carried out, the LED light-emitting part 27 will light up. The light from this LED light-emitting part 27 is irradiated by the KARURA code on a label, and the reflected light from this KARURA code is reflected in the direction of two-dimensional CCD30 by the include-angle conversion mirror 28. Outpatient department light decreases with a filter 33, and image formation of this reflected light is carried out through the diaphragm device 31 with the combination lens 32 in the location of two-dimensional CCD30.

[0046] Here, the reflected light which carried out image formation is changed into the electrical signal of the voltage level according to light income by each CCD component of two-dimensional CCD30, respectively. This electrical signal is amplified by the image pick-up digital disposal circuit 49 to predetermined timing, and is transmitted to the code image-processing circuit 48 as an image pick-up signal.

[0047] An image pick-up signal is changed into image data in the code image-processing circuit 48. At this time, the display drive circuit 51 displays the image information read to LCD25 based on this image data. On the other hand, to the changed image data, the code image-processing circuit 48 starts image data by the KARURA code section further, performs various code processings to this started image data only for a KARURA code section, and changes them into the two dimensional code image data of normal.

[0048] Based on a format of the KARURA code which was memorized by DRAM43 and memorized by the mask ROM 44, decoding of the two dimensional code image data of this normal is carried out by the decoding circuit 45, and it is outputted to a host computer etc. through an interconnection cable 23 as KARURA code data.

[0049] For example, since it is displayed in the center of LCD25 as shown in drawing 6 (a) when a two dimensional code scanner is made to approach the KARURA code of a label, and the KARURA code is positioned by the reading station of normal, if an operator can check that the KARURA code is positioned by the reading station of normal and ON actuation of the code reading switch 26 is carried out immediately, he can read a KARURA code correctly.

[0050] moreover, when the KARURA code has separated from the reading station of normal Since it is separated and displayed from the display screen of LCD25 as shown in drawing 6 (b) If an operator makes it move so that it may become the image which shows this two dimensional code scanner to drawing 6 (a) while a KARURA code can notice it separating and being from the reading station of normal and supervises this LCD25 A KARURA code can be positioned easily [the reading station of normal] in a short time. And if ON actuation of the code reading switch 26 is carried out when a KARURA code is displayed in the center of LCD25, a KARURA code can be read correctly.

[0051] Moreover, although the KARURA code is positioned by the reading station of normal Since the KARURA code which leans in the center is displayed on LCD25 as shown in drawing 6 (c) also when inclined and positioned (rotating) If an operator makes it move so that it may become the image which shows this two dimensional code scanner to drawing 6 (a) while a KARURA code can notice being inclined and positioned and supervises this LCD25 A KARURA code can be positioned easily [there is no inclination in the reading station of normal (without it is rotating), and]. And if ON actuation of the code reading switch 26 is carried out when a KARURA code is displayed that there is no inclination in the center of LCD25, a KARURA code can be read correctly.

[0052] According to this example, to thus, the read station 22 of the frame 21 cast by one apparatus The include-angle conversion mirror 28 which grasps the LED light-emitting part 27 which irradiates light at the print media by which the two dimensional code was printed, and the reflected light from a two dimensional code, and is reflected in the direction of the section is formed. Two-dimensional CCD30 constituted by arranging a CCD component in the shape of a matrix by the grip section of a frame 21, A filter 33 and the combination lens 32 to which image formation of the reflected light from the include-angle conversion mirror 28 is carried out in the location of two-dimensional CCD30, The drawing device 31 and the circuit section 29 which creates image data with the electrical signal outputted from two-dimensional CCD30, analyzes this image data, and outputs two dimensional code data to an interconnection cable 23, By having formed LCD25 which displays the image information read by the image information from the code image-processing circuit 48 on real time, it can constitute from a light weight small as equipment which reads a two dimensional code cheaply. Furthermore, since read actuation is automatically performed only by change of the lighting which irradiates light not adjusting a diaphragm to focal adjustment or focal print media, and carrying out ON actuation of the code read switch 26, since the read station 22 of this equipment is made to approach the print media by which the two dimensional code was printed and read is performed to it, a two dimensional code can be read easily in a short time.

[0053] Moreover, since the image read by this two-dimensional CCD30 can be checked by LCD25 on real time when a two dimensional code scanner is made to approach the print media by which the two dimensional code was printed, since the image information read on real time is displayed on LCD25, a two dimensional code can be positioned easily [there is no inclination in the reading station of normal, and]. Therefore, a two dimensional code can be read correctly.

[0054] Other examples of this invention are explained with reference to drawing 7 and drawing 8 . Although the example mentioned above displayed the image to read based on the image information which formed the display drive circuit 51 and LCD25, and was obtained from two-dimensional CCD30 In this example, as shown in drawing 7 , the include-angle conversion mirror 28 in the above-mentioned example is transposed to the include-angle conversion half mirror 61. The light penetrated with this include-angle conversion half mirror 61 carries out opening formation at the part irradiated by the frame 21, and forms the window part 62 fitted in and formed in this opening in clear glass or a transparent plastic. Therefore, as shown in drawing 8 , it is not necessary to form the display drive circuit 51 and LCD25. In addition, about other configuration members and circuitry, since it is an above-mentioned example and identitas, the explanation is omitted here.

[0055] When a two dimensional code scanner is made to approach the two dimensional code printed by print media in this example of such a configuration If the two dimensional code is not positioned by the reading station of normal, since the two dimensional code is not displayed in the center of a window part 62 An operator can position a two dimensional code easily [the reading station of normal] in a short time, being able to notice that the two dimensional code is not positioned by the reading station of normal, and supervising a window part 62. And if ON actuation of the code reading switch 26 is carried out when a two dimensional code is displayed in the center of a window part 62, a two dimensional code can be read correctly.

[0056] Moreover, although the two dimensional code is positioned by the reading station of normal, since a two dimensional code leaning to the window part 62 is displayed also when inclined and positioned (rotating), an operator can position a two dimensional code easily [there is no inclination in the reading station of normal, and], if this two dimensional code scanner is moved while a two dimensional code can notice being inclined and positioned and supervises a window part 62.

[0057] And if ON actuation of the code reading switch 26 is carried out when a two dimensional code is displayed that there is no inclination in the center of a window part 62, a two dimensional code can be read correctly.

[0058] Thus, also in this example, the same effectiveness as the example mentioned above can be acquired. Furthermore, since it is not related to a circuit etc. at all in this example, the effectiveness of affecting a circuit etc. moreover cheaply or not being influenced with a simple configuration can also be acquired.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The perspective view showing one example of this invention.

[Drawing 2] The sectional view showing this example.

[Drawing 3] The block diagram showing the important section circuitry of this example.

[Drawing 4] The block diagram showing the circuitry of the code image-processing circuit of drawing 3 of this example, and an image pick-up digital disposal circuit.

[Drawing 5] Drawing showing the flow of reading processing of this example.

[Drawing 6] Drawing showing the example of a display of the two dimensional code by LCD of this example read.

[Drawing 7] The sectional view showing other examples

[Drawing 8] The block diagram showing the important section circuitry of this example.

[Drawing 9] Drawing showing the example of various codes.

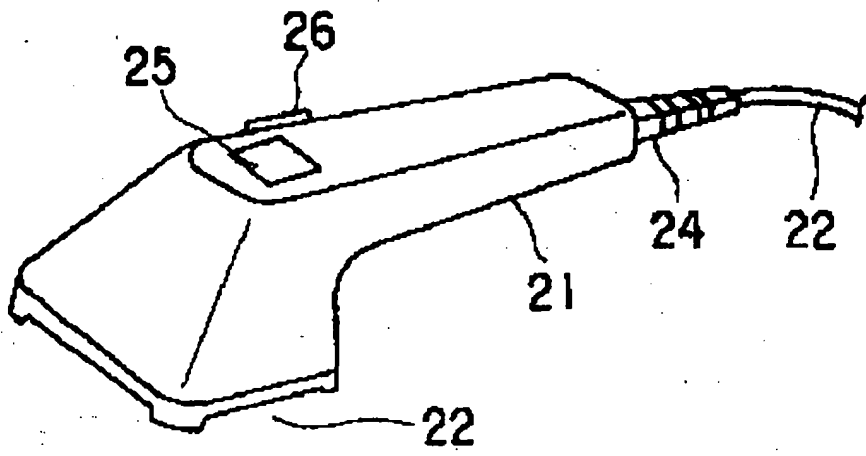
[Drawing 10] The perspective view showing the example of the various bar code scanners of the conventional example.

[Drawing 11] The perspective view showing an example of the two dimensional code scanner of the conventional example.

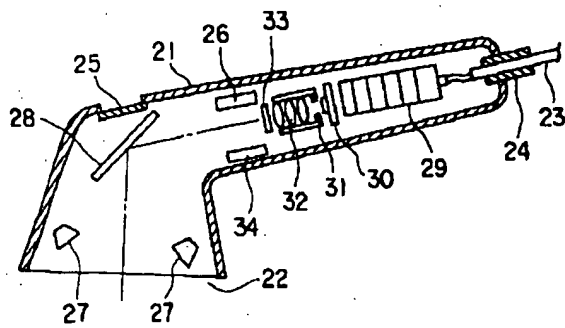
[Description of Notations]

25 [-- CPU, 51 / -- A display drive circuit 61 / -- An include-angle conversion half mirror 62 / -- Window part.] --
LCD, 27 -- An LED light-emitting part, 30 -- Two-dimensional CCD, 41

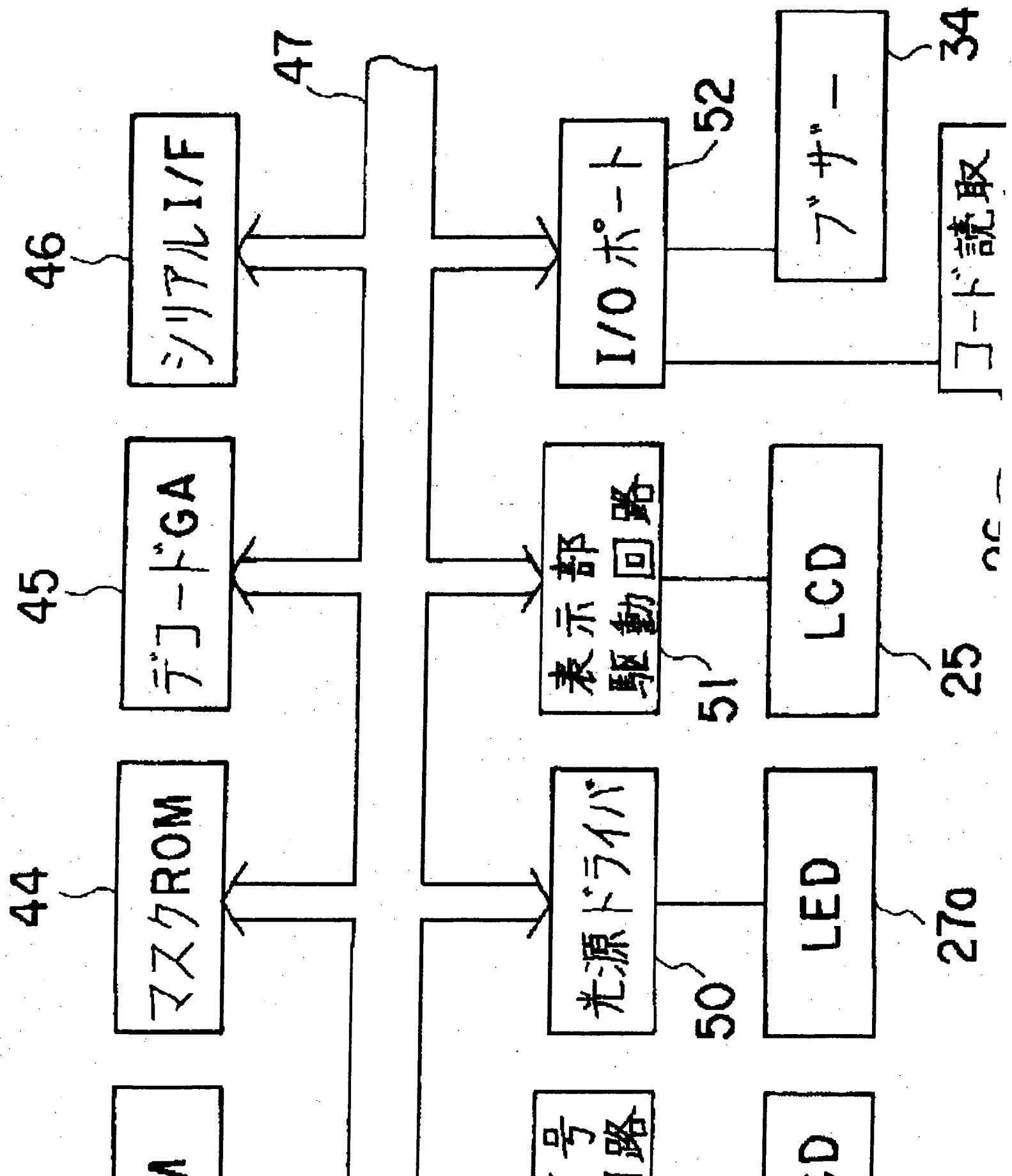
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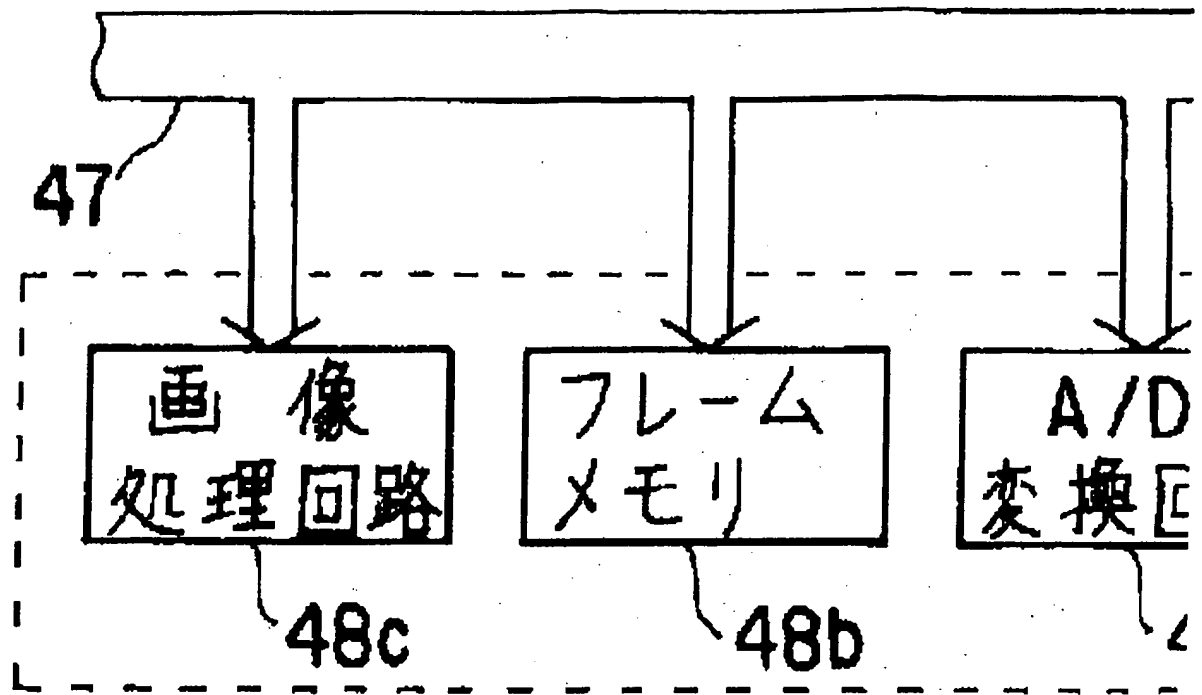


Drawing selection drawing 2

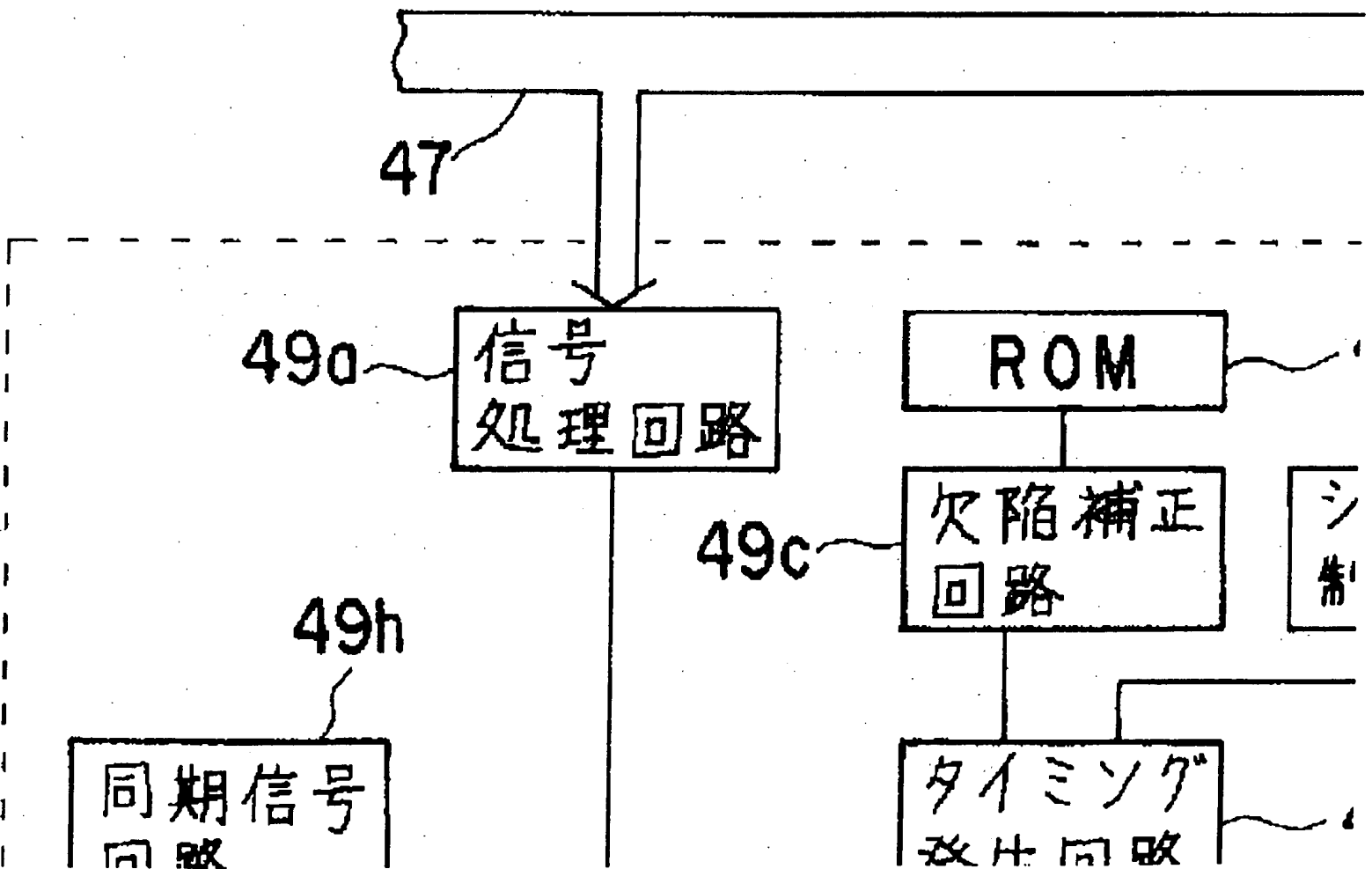


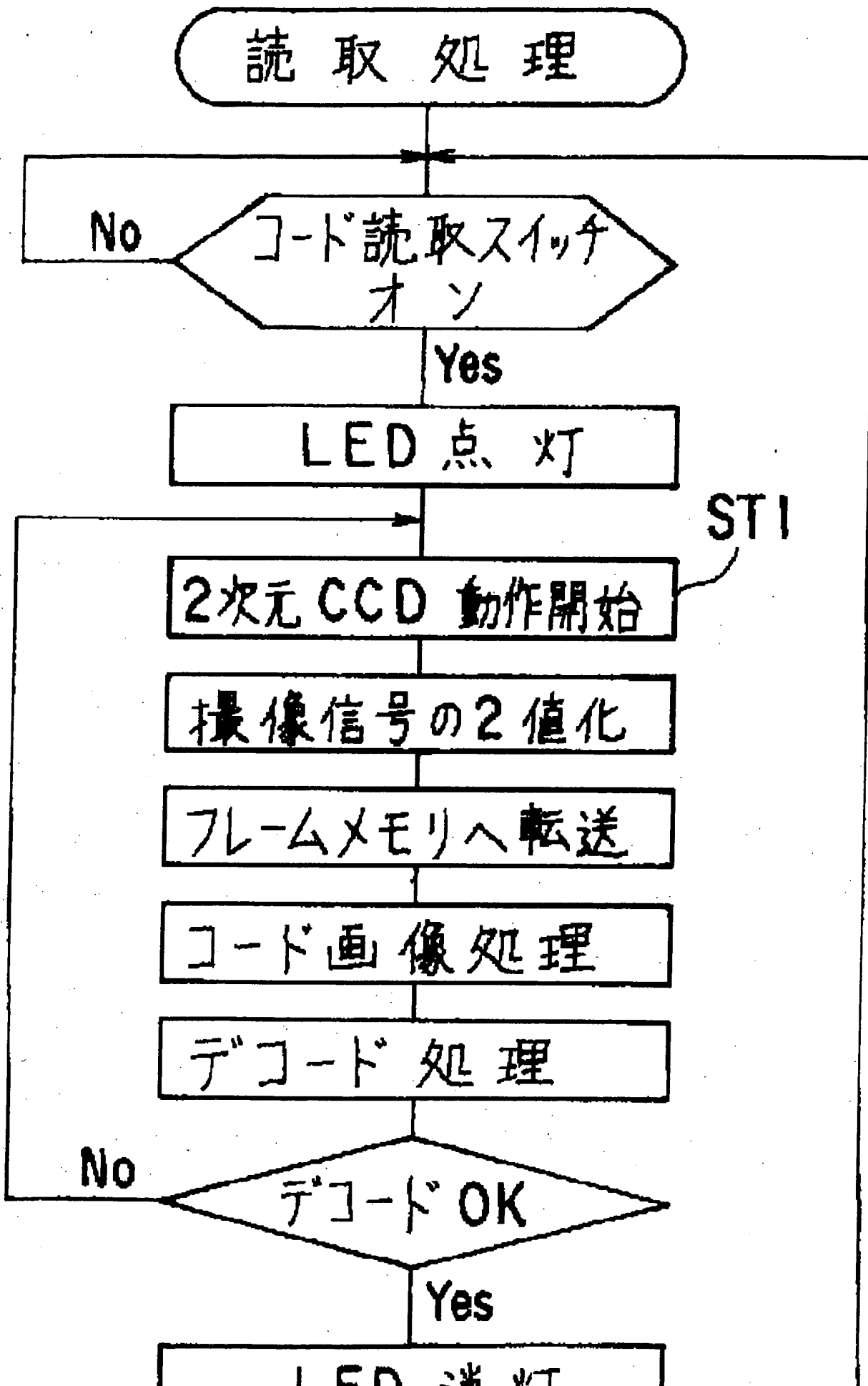
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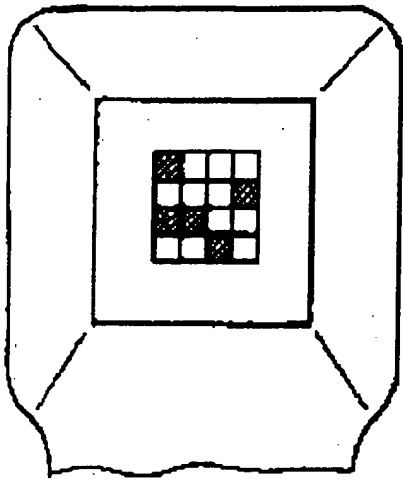




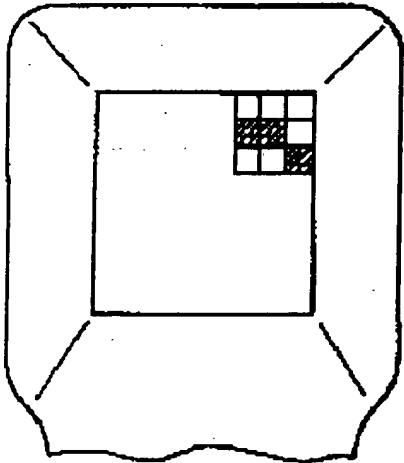
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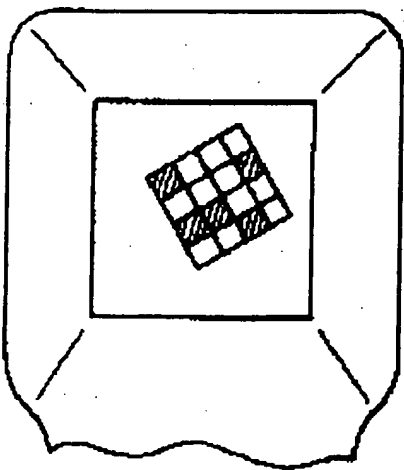




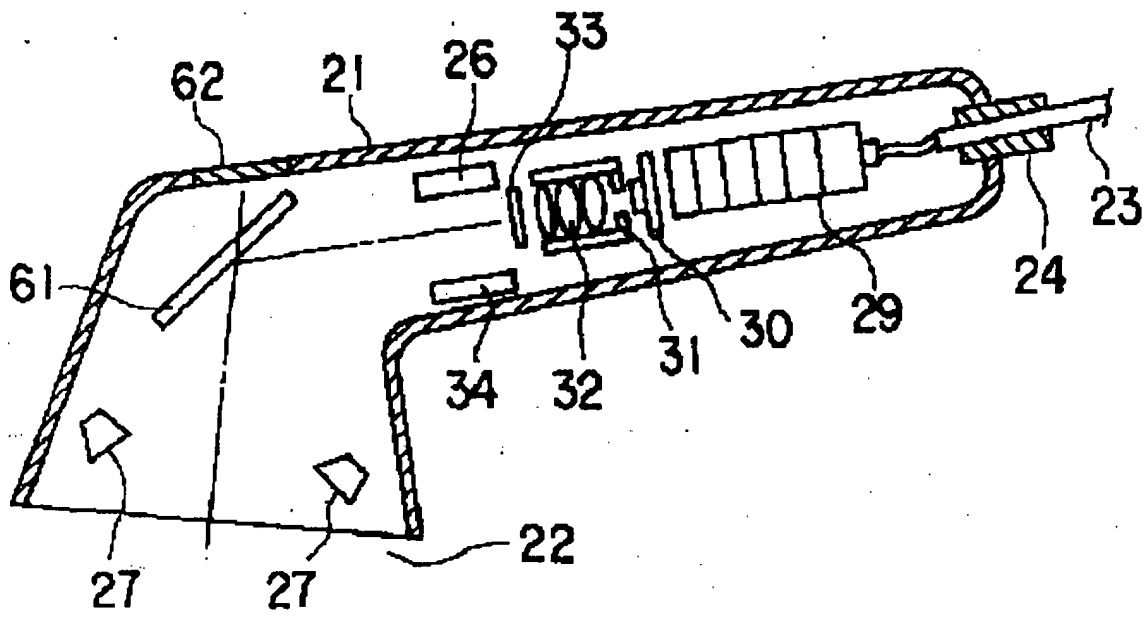
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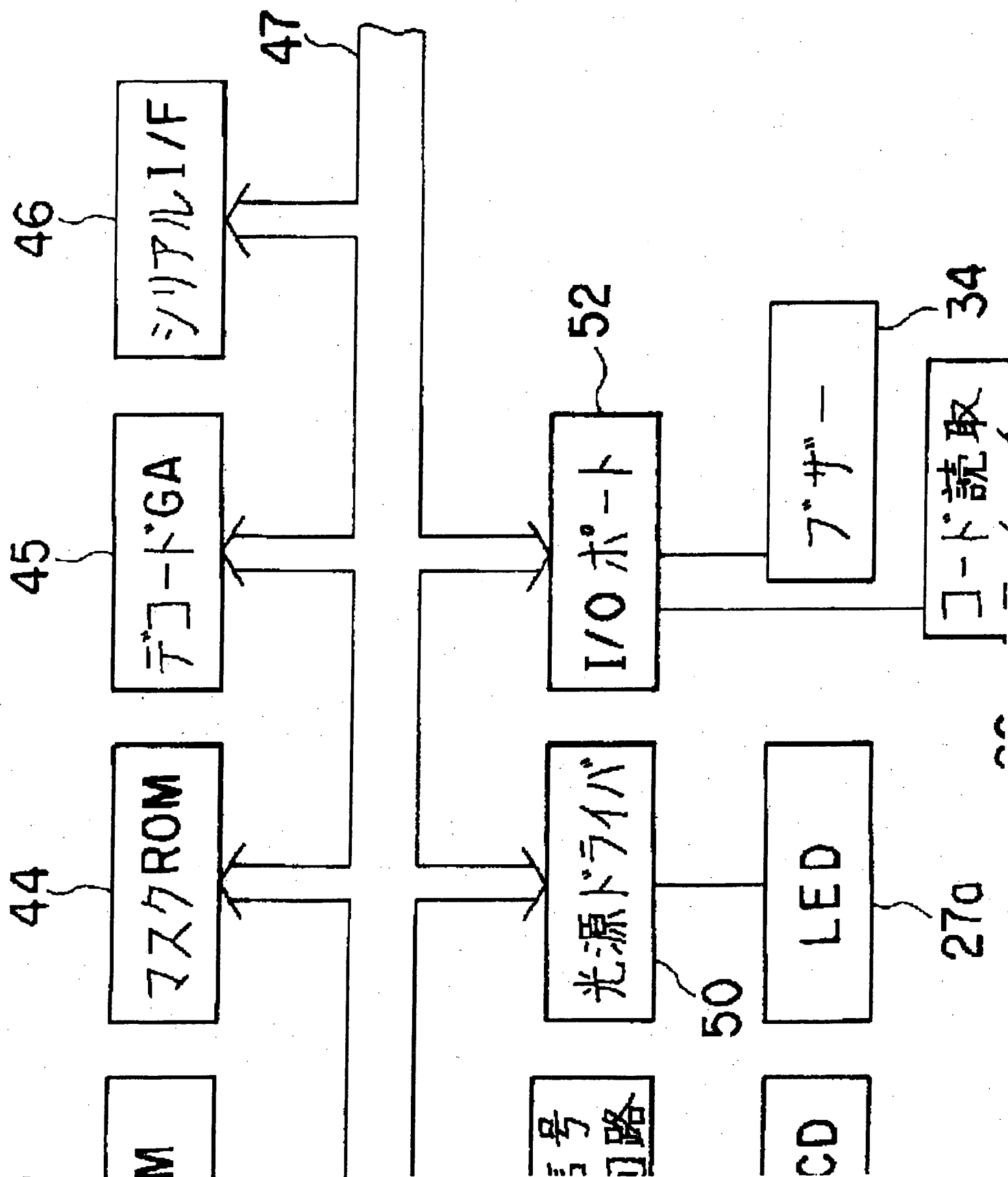


(b)



(c)







(a)



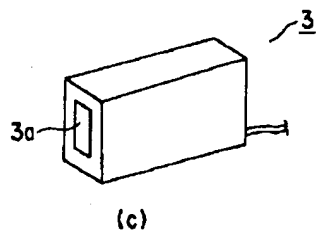
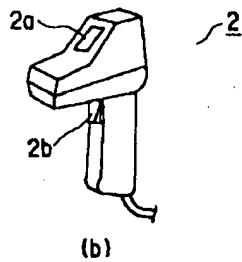
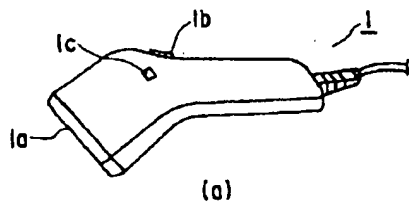
(b)



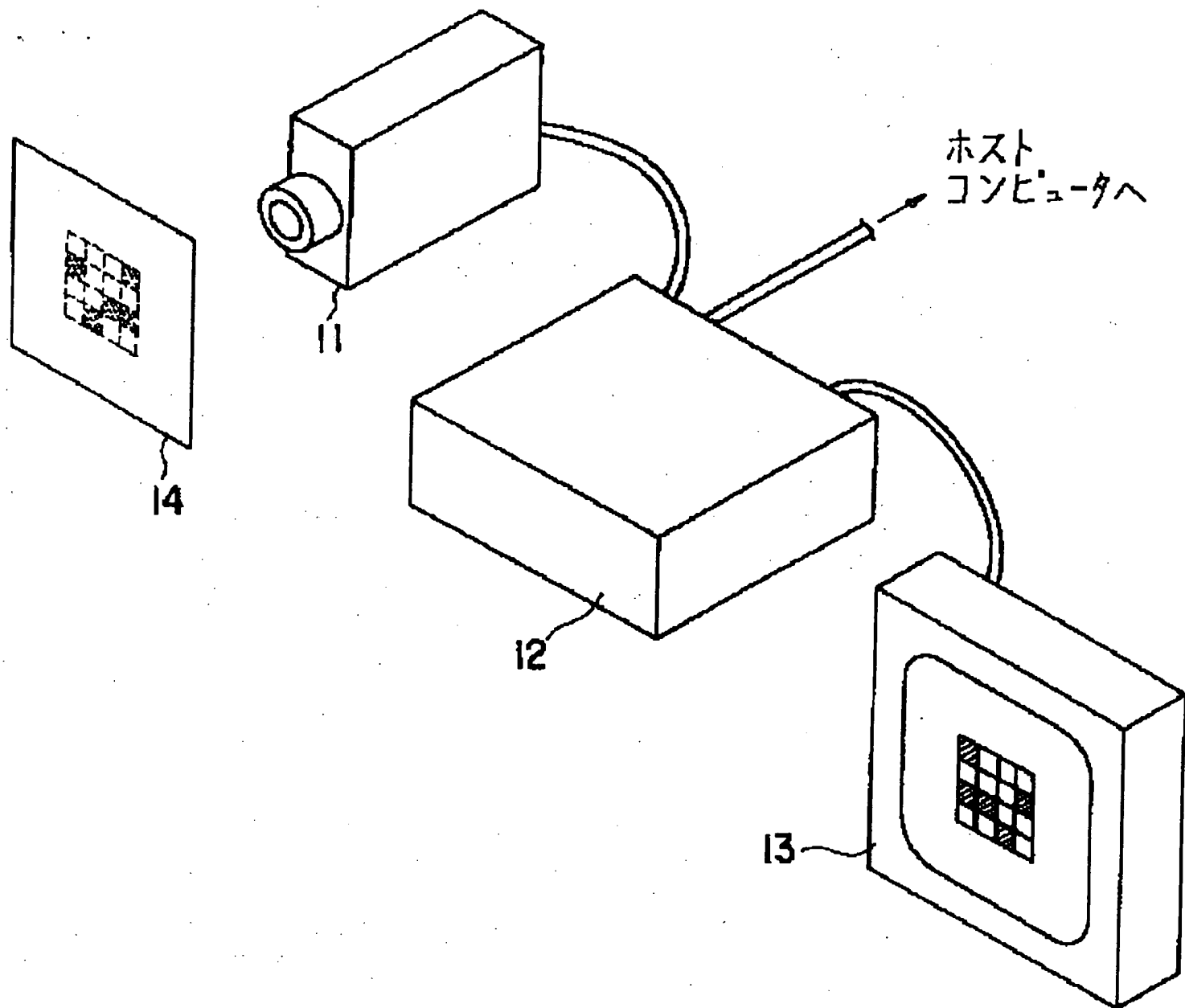
(c)

[Translation done.]

Drawing selection drawing 10



[Translation done.]



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